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241 business. Fragmentation means inconvenience, loss of time and effort in the simultaneous cultivation of different fields. The situation is the same for the well-to-do and the poor alike. Large holdings do not mean single pieces of land within a large area, but many small parcels of land, of different classification and grade, scattered like those of a less prosperous farmer. There are offsetting advantages. The greatest of these is that crop destruction through typhoons, salt spray, or flooding may be less catastrophic to the individual owner with small scattered holdings than if a family has a single large plot of land.

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425 Another effect of fragmentation is that it makes a particular plot of land difficult to sell. If one has a small plot of land, an island in a sea of other ownership, the prospective buyer is in the same position as the seller, unless the buyer owns contiguous land and has the money to make the purchase.

423 The natural question at this point is: what are the possibilities of consolidation of ownership in the interests of more efficient and convenient agriculture? The general answer, I believe, is that fragmentation is almost inevitable, consolidation only possible.

In both of the agricultural villages studied, some voluntary consolidation (kokanbungo) has taken place, but it is not of major proportions. It occurs chiefly for two reasons: (1) clustering one's land near the house site, or having two or more parcels of contiguous land is universally desired. Going to and fro is considered troublesome and onerous. (2) When branch families are established, farmers wish to exchange a distant plot for one in the village for a house site. This is often difficult to do, for such an exchange must be mutually advantageous to bring about a transfer.

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731 Typhoons are a major obstacle to voluntary consolidation into large holdings. It is perhaps possible to exaggerate this, but personal experience and conversation with villagers who have lost the entire crop of one parcel but have salvaged part of the crop of another convince me of its force. A typhoon damages a whole area but the scattered holdings provide the chance that something might be saved. The total damage is the same in any event regardless of ownership. It is the distribution of loss that varies. If in the future, land consolidation were attempted on a broad scale, either by voluntary individual effort, or cooperatively, crop insurance or some form of sharing losses would seem to be necessary.

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409 The present system of land ownership and of land use and the fragmentation of land would seem to preclude any extensive mechanization of agriculture. Even with consolidated holdings, the nature of the landscape might make the effort uneconomical, though this is a question for technicians in these fields.

common and indispensable tool. It has many uses, including cutting rice stalks at harvest, brush, and sweet potato tops. 412

3. A small sharp pointed hoe, with a short handle, used in sweet potato planting.

4. A two pronged hoe, the futamata, used mostly with sweet potatoes. The two pronged hoe is used in softer soils. It is much more common in Matsuda than in the southern villages.

5. The three pronged hoe, the mutsumata, also used in sweet potato cultivation and in digging. These prongs, with skilful use, do not cut the potato. It is also much more common in Matsuda than in Hanashiro or Nagamo.

6. The common all purpose hoe (kuma). It has a thick, solid, wide blade. The handle (about 3 1/2 feet long) is stout. The hoe is much sturdier than the ordinary American garden hoe.

7. Another hoe, longer and with a sharper angle between the handle and the blade. It has a variety of uses.

8. A long handled hoe with a heart shaped blade. It is used for making furrows.

9. An ordinary rake.

10. A cultivator and weeding tool for rice paddies. (The pole in back near the handle of the pitchfork is a prop to hold the tool upright for the picture). Only the more prosperous farmers possess this tool. Rice weeding is done almost entirely by hand. [93A]

11. An ordinary pitchfork.

12. The plow (suki) 407

13. The harrow (magawa), and

14. The waku, a hexagonal wooden frame used in laying out a rice field for transplanting. The last three tools or devices, which are not shown in the picture, will be described under rice cultivation. 413

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The Annual Work Cycle

The following charts show the annual work cycle by lunar month of two farmers, one in Hanashiro, one in Matsuda. The Western calendar equivalents for 1951-52 are shown below the lunar month. Because the lunar year is shorter, there is a gap, as the period actually covered is from February 6, 1951 to January 26, 1952. These materials are based on observation and conversation with the farmers concerned. 221
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HAMASHIRO

FIFTH MONTH
(June 5-July 3)

This and succeeding month the busiest of the year. Harvesting and threshing of soy beans. Plant sweet potato slips.

MAISUDA

Busiest month continuing through the sixth month. Soy bean harvest. Flots formerly occupied by soy beans put in sweet potato slips which were sown in the 4th month. Heaviest sweet potato planting of the year.

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SIXTH MONTH
(July 4-Aug 2)

This and the previous month the busiest time of the year. Continue with soy bean harvest if required. Harvest of red beans, kidney beans (ingername). Plant sweet potato slips. Beginning of summer planting of sugar cane which continues until the 8th month. The rice harvest. Rice threshing. Begin digging up the wet and drained fields. Beginning of transplanting preparations.

This and the previous month the busiest time of the year. Sweet potato planting. Rice harvest begins about 10th of the month. Rice threshing with the treadle thresher (dakkoidi). Rice land with cropped plants turned under. From 10-20th preoccupation with rice. Replanting of rice seed beds after testing. From 20th to 30th rice planting. Other rice lands fertilized, prepared for transplants. Beginning of transplanting.

[407]

SEVENTH MONTH
(Aug 3-31)

Planting of rice in the seed bed. Beginning of transplanting of rice shoots from seed bed (about 20 days for growth). Continues through 8th month.

Transplanting rice continues until the 10th. Plant sugar cane. Plant sugar cane slips if there is rain. Begin weeding rice fields about the 10th.

EIGHTH MONTH
(Sep 1-30)

Plant onions, tomatoes, carrots, lettuce. Plant wheat (komugi), barley (omugi), and naked barley (hadaka mugi). Plant sweet potato slips. Continue and complete the rice transplanting. Begin weeding the rice plants.

Rice field weeding continues. Done three times in three weeks until about the 15th. Plant sweet potato slips if sufficient rain.

NINTH MONTH
(Oct 1-29)

Sow horse beans (sora-mame) and barley

If rain, sow sweet potato slips, sow wheat, radishes, tomatoes, leafy vegetables (ha no yasai) and Chinese cabbage (hakusai)

243 by plowing.

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There is water on the land when it is dug and harrowed, but it is not flooded. Not all rice land is harrowed. If it is not harrowed, the same result is accomplished by further hoeing. The harrow (magua in Japanese, maga in Okinawan) is partly a home made tool and looks like a large clumsily constructed rake. Essentially it is a piece of timber with a row of strong spikes. This timber ordinarily is made of pine, but other woods may be used. Twelve nails, spaced at about two inch intervals, are driven into the board. These nails or spikes, about 8 sun (almost 10 inches long), square at the head, and with a sharp point, are made by a blacksmith for about Yen 20 each. The harrow is drawn by cattle; two shafts, with a yoke over the animal's head complete the simple implement. The plow is used in the preparation of the field, but far more commonly, the work is done with a hoe.

In the fall and winter planting of rice, the seedlings remain in the seed bed for about 40 days. In the summer, the period is only 20 days and may be less. The winter shoots are from 7-8 inches long, the summer shoots from 4-7 inches. The length is important, for if the seedlings are too long, losses in transplanting will, according to Hanashiro farmers, increase to almost half. In rare instances, due to adverse conditions, seedlings in the seed bed reach 15-20 inches in length. The losses here are said to be considerable in transplanting.

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The hoeing or the plowing and harrowing of a field is almost exclusively done by men. It is tiring, uncomfortable, and heavy work. It is much more common to see women hoeing the dry crop land. But transplanting is done by men, women, and the older children. A handful of seedlings in the bed is pulled out and bound with straw, grass, or a rush. There is a knack in pulling these out. They must be jerked quickly, but dexterously to avoid root damage. The bundle is tossed either into a central place or into the paddy field to be planted, if it is adjoining. In the latter case, the bunches are tossed to various parts of the paddy.

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The seedlings are generally set out in rows. For this purpose, a string with small markers like buttons (shirushi) is used. These are 7 sun (about 8.4 inches) apart. Both the rows and the hills are 7 sun apart. Differences between rows and hills may vary considerably. In these localities, the distances were generally the same. The string is stretched from one end of the row to the other. Each seedling is planted at the interval indicated by the marker on the string. This method of planting is not universal. When there is little time, the seedlings might be scatter planted.

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Another method of obtaining the checker-board pattern is by means of a home made hexagonal frame, the waku (literally, a reel or a frame). Each of the six sides is divided into nine squares, 7 sun on the side. The overall length is over six feet. The frame is set along the outside border, or at any desired starting point. When in place, the

bottom will imprint nine squares on the wet soil, and as it is turned another nine will be imprinted so that when continued the field is laid out in tiny squares. Three or four seedlings are planted on the corners of the square made by the waku.

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Men operate the frame. As they turn it, making the square pattern on the damp soil, women follow behind with the seedlings. The frame has been in use in Matsuda for about fifteen years. An Okinawan agricultural school student is said to have invented it. It was not used in the southern villages studied, an interesting sidelight on the slowness of innovation even on a small island like Okinawa, for many farmers in the south expressed surprise at its use and had not heard of it. The device is helpful to those with large plots. In Matsuda, there are not many of these frames, but borrowing is frequent.

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In contrast with recent introductions, such as the universal treadle thresher, the frame seems to be confined to one geographic area. The reason for this may be that the use of the thresher was actively encouraged by the Japanese as a successful time and labor saving device, while the frame was not similarly publicized.

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Another method, a more traditional one, is to use a piece of wood the same length as the waku with seven little knobs and the two ends to give the nine spaces. This is the jiyopi. A piece of string stretched from one end of the field to the other is used to get a straight line along a row. When the planting has taken place along one row, the jiyopi is used to measure off one space between rows, the guide line is moved over and the operation repeated. This achieves the same purpose as the frame or the string with the markers. Men are more likely to handle these operations, the women following along with the transplanting. But the division of labor is by no means hard and fast.

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Care of rice until its maturity. Rice set out in squares is easier to cultivate, weed, and harvest. During its growth, it will be necessary occasionally to loosen the soil or to break up clods which escaped the initial working. There may be some temporary drainage of water off the fields at these times.

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Weeding rice is usually done by hand, though once in a while a farmer has a hand cultivator. Weeding the rice field is an unrelenting job which is done about once a week. More attention is given to this task when the plants are younger. Weeding is worked in with other daily chores, and all members of the family may participate.

The rice is now allowed to grow with the hope that strong winds or a typhoon will not blow over the slender shoots or submerge them. If the rice is submerged when the shoots are still fairly young, they will gradually right themselves. Farmers say that attempting to upright the plants by hand will not work. The quality of rice once submerged is poor and sometimes half the rice in the plot is lost. If the submersion occurs when the plants are near maturity and the stalks are 20 or 25

243 inches high, the bottom of the paddy becomes a tangled mass. Farmers walk disconsolately away from a field like this, often without even attempting to harvest the crop. The seeds once soaked will produce inferior rice. In this case, the farmer may turn the whole crop under or salvage some for pig food. The growing of rice is one long gamble with the wind and with typhoons, and there is seldom a year in which some rice is not destroyed.

[221] The harvest. The cutting of rice at harvest time, July and November in the western calendar, is done in a uniform manner. (Harvest times may vary somewhat from place to place). A bunch of the long stalks is grasped in one hand and cut off with the small sickle. A stubble of a few inches is left in the field. The sheaves are tied up with a piece of rice straw and thrown in piles. The commonest and most convenient way of carrying the sheaves from the field is to tie several together. A large bundle of these is carried on either end of a pole which rests on the shoulder. The ends of the pole are cut like tenons and stuck in the bundles below the binding. The rice is carried to the courtyard to be threshed. If necessary, it will be allowed to dry for a few days.

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407 Threshing, hulling, and milling. Rice is threshed either in the courtyard of the home or in a flat place near the house. During rice harvest, the threshing machines can be heard all over the village, the noise suggesting the sounds of cars on a railroad track, heard from a distance. The device now universally used for threshing rice is the dakkoki.

This has a foot treadle, similar to an old fashioned sewing machine. Working the treadle up and down causes a drum, set at about waist length, to revolve. This drum has a series of wires set in rows and bent over, appearing like large staples. These staples are parallel with the line of rotation of the drum.

[462] A conveniently handled bunch of stalks (wara) is held on the revolving drum, the rice seeds touch the staples, which knock the kernels off. They drop to the floor of the device. Often the top has a canvas cover to catch the flying rice kernels and the machine is set in the middle of a large piece of canvas so that the grain can easily be recovered. Both men and women do this work, although women seem to do more of it. They are free to work while at home, alternating the task with other chores. They keep up with the man and the elder children who are carrying the rice bundles in from the fields. After threshing, rice straw is thrown aside. It has many subsequent uses.

[177] The dakkoki, an introduction from Japan, is new in Okinawa. In Hanashiro it has been used scarcely 15 years. Prior to this, more primitive methods were used which can still be observed in Matsuda today. These old methods are no longer important, but they are of interest because they were used, instead of the treadle threshing, up to pre-war times.

One of these, the shimba (ninihi in Okinawan) is essentially a concave forked piece of metal set on a frame, which in turn rests on four props set up in sawbuck fashion. The rice sheaves are drawn through the teeth, causing the kernels to drop below. The sawbuck may be any desired height. Usually the top of the fork is waist level. The only significance of the shimba today is that it provides diversion and occupation for the old women, many of whom are too weak or too unsteady to operate the treadle thrasher. The same is true of an even simpler device for threshing. Two short pieces of bamboo, or any piece of round wood, a little longer and with a slightly greater diameter than a pair of chopsticks, are loosely tied together on one end with straw or a strong blade of grass. The tied ends of the two sticks are held in the right hand, leaving the free ends to strip off the rice kernels from the straw. This labor is done by very old women. Age is no deterrent to work as long as people are able to get around. But, as in the south, the treadle thrasher is universally used. This device was widely distributed by the Japanese agricultural specialists of the government throughout the empire in the years immediately before the war. In Matsuda, it is also thought to be about 15 years since its introduction. 243 407 [887]

As in Japan, from which the terms were borrowed, rice in various stages of cultivation and processing is known by different names. Rice in the hull is monai; unpolished rice is genmai, and polished rice is hakumai. Rice stalks are known as wara. 824 192

Hulling and polishing rice by machinery are also new in Okinawan villages. In Hanashiro, those machines driven by an open belt are about ten years old. A hand mill, the shirushi, to be described shortly, was in general use for polishing rice up to 1940. 256

At present everyone, no matter how poor, pays for hulling and polishing of his rice. The mill owner in Hanashiro estimated that the machinery processed in ten minutes the amount of rice that formerly took a day to hull and polish by hand. Poor families do not try to effect savings by hand work. They pay the fee, sell the polished rice, and eat sweet potatoes. [511] [262]

Unpolished rice is disliked and is never eaten. It is described as hard and bitter in taste. The machinery in a rice mill varies from place to place in quality and modernity. The mill (seimaisho) has two machines: a hulling machine (momitsuriki) and a polishing machine (seimaiki). One simple type of a hulling machine is an endless chain type of mechanism. The rice is put in little buckets on the chain which carry it to rubber layers. As the rice is forced through the layers, the hulls are cracked and pinched off, and are then blown out on a pile in back. After being hulled, the rice goes through the shaft of the milling machine. The shaft housing is grooved. As the shaft revolves, it polishes the rice which is going through it. The shaft also gets heated, and this makes the polishing easier. In the older machine in Hanashiro, the rice was put through the shaft ten times



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Matsuda. Polishing rice with a hand mill. This is a posed picture, but rice was polished this way up to shortly before the war. The grass mat prevents wastage. On the left is some Yambaru bamboo. The women are bare-footed. The towel-like headdress is not uncommon.

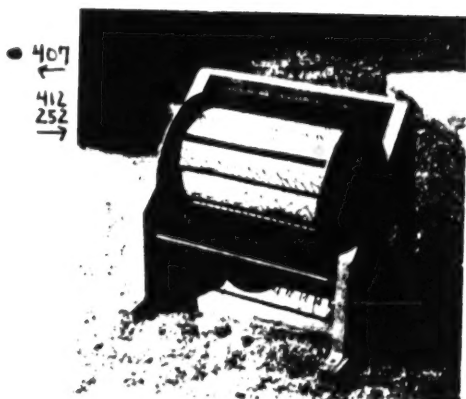
[P. 185(A)]



chichiūshi



wooden rotary mill



dakkokki



wooden rotary mill

[facing p.17]

It apparently did not find widespread use in Tomoyose, for that village passed almost directly from the use of bamboo tongs to the rotary thresher, or 'dakkokki' (see photo). Yamada first saw this thresher about 1933, but Nanahan farmers began using it only in 1941.

Hulling of grain was in the past accomplished---as needed for home use or sale---by using a wooden rotary mill (see photos) called fichiūshi in Yamada and shiriūshi in Nanahan. In Yamada two women sat with their feet braced against it, and pulled straw ropes alternately. In Nanahan men did the hulling, and the rotary mill was lower but was three feet in diameter. In the late thirties motor-powered hulling mills were built in many areas, and farmers took their rice there for hulling and polishing.

Polishing of brown rice in Nanahan was accomplished until about 1935 by use of a mortar, or chichiūshi (see photo), and pestle, or ajin. Most families still have these in reserve, as they were used after the war and were replaced by rice mills only after 1949. People in remote areas still use them exclusively. Nowadays people have their rice hulled and polished in one operation at a rice mill, if it is close at hand.

Very little wheat was grown in the three farm villages studied, but it was noticed that on the outer isles wheat was more dominant. On Henza isle, removal of the grain from the sheaf and hull was accomplished by rubbing it upon a piece of bumpy limestone. On Kudaka, separation was by rubbing on a canvas, both with the hands and feet.

After the war farmers took advantage of the spread of the lantana bush, which had flourished due to the neglect of the land. It furnished an excellent livestock feed, and also a short pole which they could use in roofing their rebuilt houses. Such poles, or kichigwā, had formerly been brought down from the forested north country.

Chronology of Change in Livestock Recovery of the land after the war proceeded far more rapidly than replacement of the livestock killed or eaten in the invasion. The following table illustrates the loss and slow recovery (except for swine) in livestock numbers:

Table V

Type of Livestock	1940 ¹	1946 ²	1952 ³	1952 as % of 1940
Cattle	22,000	112	6,837	31.0%
Horses	25,000	899	5,110	20.4%
Swine	108,425	1,165	107,077	98.8%
Goats	106,257	1,347	58,472	55.1%

In Kachinda-son the story has been somewhat the same, with the exception that there are many more swine and cattle now than in the thirties. This is due partly to the lesser amount of land in sugar and the planting of more

1, 2 Summation....July-November, 1946, p. 26.

3 Ryūkyū tōkei hōkoku, Vol. 3, No. 3, 1943, p. 1. Valid as of 31 Dec. 1952.

178 In Kanegusuku, for example, mat weaving is still of some importance
 286 as a home industry. Where formerly nearly all of the houses were engaged in
 433 production of mats,
 today less than half are so engaged, and the acreage planted in sedge is but
 ten percent of the prewar level. The war caused the loss of many machines;
 increasing emphasis on food production has brought a conversion of sedge
 fields into paddies; access to the better markets in Japan is now more diffi-
 cult than before the war; it is felt to be too time-consuming and the young
 women today do not like this work.

Formerly there were a number of men in Kanegusuku who were able to
 construct the looms used in mat weaving. Today, however, no one constructs
 his own looms; instead, they are purchased from a manufacturer in Itoman.
 [463] This particular example is symptomatic of the general decline of do-it-
 yourself and the increasing reliance placed on specialists.

178 There are some encouraging signs of revival or new life in the manu-
 facture of Okinawan art objects. Okinawan lacquer ware, which is acknow-
 [322] ledged by some to be the world's finest, is being sold in large quantity to
 members of the occupation. The owner of a large pottery works in Naha told
 [323] the author that pottery from tombs is being collected to serve as models in
 restoring an older style and superior type of pottery. An Okinawan textile
 [286] technique known as biingata (Okinawan; in Japanese, 'Benigata') was virtually
 lost during the war, but this art is still being carried on by one Shuri
 family, and recent publicity and aroused interest seems likely to insure sur-
 vival.

178 Power and Machinery Agricultural machinery has come into use quite
 recently on Okinawa. Pitts states that the labor-saving rice thresher first
 407 came into widespread use in the thirties. Older methods of flailing or rub-
 bing the rice over a mat, carvas, or stone surface were also observed as being
 in common use. In numerous instances it was brought out that wartime losses
 had necessitated a return to an earlier and cruder means of threshing.

The old-fashioned, hand-operated rice polisher has gone out of use in
 Kanegusuku, and all rice is now polished in the village rice mill which op-
 erates on a gasoline engine.

In many communities the gasoline-operated sugar mill has replaced the
 [257] horse-powered mill. More important, however, is the fact that the small com-
 munity mill remains popular, and the farmer is resistant toward using the
 large sugar factories (see chapter on Rural Economy).

178 Electricity, common only to the towns and cities before the war, is
 379 now found in many villages, and those who are without it are looking forward
 [373] to its installation. The kerosene lamps now in use in most rural homes cast
 a dim light and constitute a serious fire hazard in homes of thatch and wood.

The bulldozer has come into use as a means of opening new land and
 178 constructing rice fields. Farmers in Kanegusuku and Nanahan made use of this
 406 method during the period of the authors' study of these two villages. Formerly
 this sort of work required the labor of a number of men over a considerable